Line & Berry Chest of Drawers

BY GLEN D. HUEY

Though not traditional, router patterns make quick work of the inlay.

In southeastern Pennsylvania, just northwest of Philadelphia, is Chester County. It was one of the original three counties formed by William Penn in 1682, under a charter signed by King Charles II. In 1729, a large portion of the western county was split off to become Lancaster County, and in 1789, the southeastern townships closest to Philadelphia were organized as Delaware County. That left Chester County as we find it today.

Throughout the 1700s, Chester County furniture makers produced pieces with unique surface decoration, such as the line and berry inlay shown on this chest. Furniture makers of the period scribed inter-connected half-circles into the surface. The design was scratched using a compass, which is why the process is often referred to as "compass inlay." Sometimes, at the termination of those circles, small groupings of round berries completed the design. This decoration reached a popularity peak in the 1740s.

Where to Begin?

The striking feature on this chest is the inlay on the drawer fronts – but the chest, on its own, has attributes not often seen in furniture construction.

Begin by prepping the panels for the case sides and bottom. Notice that there is a difference in the widths of these components. The 5/16" offset allows for the added double-bead moulding on the case sides and drawer blades, a common feature during the William & Mary period. That offset is at the front of the chest, so when transferring your dovetail layout, work with the rear edges of the panels aligned.

There is quite a bit of work needed on the case sides. Dovetails join the sides to the case bottom and single sockets hold

Inlay gets noticed. *This arresting, seemingly complex inlay is accomplished using a router and series of patterns.*

the support rails, both front and back. From a pins-first point of view, set your marking gauge to 5/8" and scribe the two case sides along the bottom edge. Why 5/8" when the thickness of the bottom is 3/4"? It's to hide the dovetail joints when the base pieces wrap the chest. Lay out and cut the pins in the case sides.

With the pins complete, mark the case bottom where the front edge of each side ends. Chuck a straight bit into your router, set the depth of cut for a shallow rabbet that leaves 5/8" of material and clamp a fence even with the inside layout line. Now make the cut from that mark to the back edge of the bottom on both sides. The rabbets help register the sides to the bottom and provide a more accurate transfer of the pin layout. Cut the tails at both ends of the bottom and fit the joints. Tweak the fit as necessary.

After the dovetail joints are fit, lay out and cut four sockets at the top of the sides, along the front and rear edges. The tails for the support rails slip into the sockets from the top down. The front support rail fits 7/16" behind the front edge of the sides; the rear support rail is set flush to the backboard rabbet, or 3/4" in from the rear.

Slide-in Blades

The drawer blades attach to the case sides with sliding dovetails. Lay out the sockets along the front edge of each case side and on the back edge for the one rear blade, making sure that each location matches its counterpart in the opposite side – you want the blades to be level across the front of your chest. Slide a 3/4" dovetail bit through a 3/4"-outside-diameter guide bushing, then chuck these in your router. Position the platform to the left of the socket area as shown in the top right photo, then cut the 1/2"-deep x 2 1/4"-long sockets. (Read more about this technique in the November 2008 issue of *Popular Woodworking*, #172.)

For the backboards, cut a 7/16"-deep by 3/4"-wide rabbet along the rear edge of the case sides. Now the work on the sides is complete.

Next, mill your drawer blades, front top rail, support rails, vertical divider and drawer runner stock to thickness and size. To get exact lengths, measure off of your assembled case. The blades' lengths includes the two dovetails, as do the support rails. The top front rail runs from outside edge to outside edge.

Disappearing joinery. *Form the tails in the case bottom after you cut a rabbet 1/8" below the inside surface. This allows the base moulding to cover the dovetail joint.*

Strong connections. *The top and rear blades are mortised for the housed and center runners. The lower drawer blades have a single mortise cut at each end to hold the runners in position.*

Dry-fit the sides and bottom, position the support rails to the sockets cut in the sides, then transfer the layout onto the rails. Trim the ends then fit the rails to the case – be sure to mark front or rear. The drawer blades get the tail portion cut into both ends. Do this with the same dovetail router bit used to create the sockets. Install the bit in your router table and adjust the cut height first, then set the fence to cut the sliding tail to fill the socket. (It's best to test the setup using a scrap of the proper thickness of stock.) To complete the work on the blades, lay out and cut mortises for the runners.

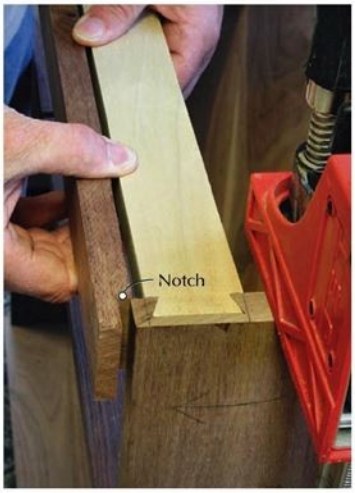
A Runner to Ride On

The next step is to assemble the case. Apply glue to the bottom, sides and dovetails, and slip the joints together. For the front blades (leave the rear blade floating), apply a dollop of glue at the front of each dovetail slot then add a thin coat on the tail before slipping the blade into position. A light touch with a mallet should set the blade flush with the front edge of the case sides – that's a correct fit.

In the center of the front support rail, cut a through-mortise that's 1/4" wide and 1 1/4" long (oriented front-to-back) for the center divider. Take a look at the photo above. The divider has a unique shape because the top notches around the front top rail as the tenon fits through the sup-

Best router setup. *A platform jig, 3/4"-dovetail router bit and a 3/4"-outside-diameter guide bushing are used to create the sliding dovetails that attach the drawer blades to the case. It's simple.*

Want to make it easy? *All the joinery work on the center divider is hidden – covered by the mouldings or the top. To make quick work of the divider, attach the piece to the blade and support rail with screws.*



Built out to match. *Here you can see exactly how the front top rail fits with the support rail to bring the front edge equal with the case bottom. The notches at the ends of the rail are nibbled away at the table saw.*

port rail. The divider is joined at the bottom with a 1/4"-thick dovetail that slips into the top blade. That's a lot of work. If you want to simplify the process, a couple screws through the rail and blade make this quick.

With the center divider ready to install, add glue to the joinery, including the sockets in the case sides and the dovetails on the support rails, then slide it all together. The front top rail fits tight to and is glued to the support rail and wraps over the case sides, building out the 5/16" to match the case bottom. The notches are cut at the table saw.

Cut tenons where needed on the ends of the runners. The housed and center tenons each get a 1/4" tenon at the front and a 1" tenon at the back. Glue the tenons in position (the rear tenon is not glued, which allows for seasonal movement) square the runners, then nail them to the case side.

"The person interested in success has to learn to view failure as a healthy, inevitable part of the process of getting to the top."

— Dr. Joyce Brothers (1928 -)
psychologist, actress

Set for change. *The bottom drawer runs on the case bottom and the top bank of drawers rides on housed runners. The middle runners, to allow for seasonal changes, are attached to the case side with cut nails.*

Left-hand stop. *The magnetic stop set to the left of the material is used to precisely align the moulding profile with the saw blade. Push the stock tight to the auxiliary stop then pull the table saw fence tight to the stock before ripping.*

Keep Your Bevels Sharp

Except for the bottom and front top rail, the front face of the chest is covered with a double-beaded moulding. Use a traditional beading bit to form the twin beads. The setup for the beaded moulding requires accurate adjustment to get the beads evenly spaced without the second pass cutting into the first bead. Once set up, create the profile on a wide board that's milled to the proper thickness. Slice the moulding from the board then produce another set of mouldings until you have the pieces needed.

Use blue tape to hold the moulding pieces to the case sides then use a chisel to mark the exact location where the blades meet the sides. From those marks, draw lines along the back of the moulding at a 45° angle to show the waste area that's removed to accept the end of the blade mouldings.

Saw as much of the waste out as you can without working past the lines then pare exactly to the lines. To keep the edges square and the angle correct so the perpendicular moulding fit is tight, use a simple V-shaped guide block. Pare the V-shape until the chisel rides the guide block.

The bead mouldings that cover the blades have pointed ends to fit the V-shaped cutouts. Form the ends just as you did on the side mouldings. That's easy. The trick is to get an accurate cut length. It's best to cut it long then pare to a good fit. The center-divider moulding is cut square, to fit against the front top rail.

To attach all the mouldings, add a thin bead of glue to the back of each then secure the pieces to the case with blue tape. Add a few inconspicuous 23-gauge pins to help keep pieces from moving.

Simple & Solid Base

The base for this chest is as simple as it gets. Mill the pieces to thickness and size

Accuracy is important. *A sharp chisel marks the beaded moulding exactly at the place the V-shape is to be cut.*

Back up that cut. *The V-shaped notches that accepts the drawer blade bead moulding need to be perfectly cut, as do the mouldings. Use a backer with a 45° opening cut made at the table saw to pare them.*

Form the foot. *Use a 1¾" Forstner bit to clean out the rounded portion of each design that forms the spur. Then at your band saw, cut away the remaining waste.*

Work on your bench. *Use scrap 8/4 to raise the chest off your bench and make fitting the base that much easier. One piece at each corner does the job.*

before adding your favorite profile along the top edge. Next, miter the pieces to length using the chest as your guide. The top edge of the base is flush with the top edge of the case bottom. After the pieces are fit, trace the cutout profile at each end of the three pieces and draw a line connecting the profiles.

The base pieces have a thin bead of glue along the top edge and are attached to the case using cut nails. To keep glue squeeze-out to a minimum, cut a shallow groove on the back face of the base approximately ¼" down from the top. Align the front piece to the chest then add a couple clamps to hold it in place and tight to the chest. Add glue along the front 6" of the base side, position that piece to the front piece and tack it in place with a 23-gauge pin. Work the second side, too.

Next, remove the front piece, add glue along the top edge and on the miters, then clamp it back in place. Pin the mitered corners to keep them aligned until the glue sets. For an authentic look, drill pilot holes and install cut nails in the base, with the nails set just below the surface.

To complete the base, slip the rear feet in position and reinforce the corners with glue blocks. The chest actually stands on the blocks, which extend slightly beyond the base. Glue blocks should also be installed along the base/bottom intersections behind the feet.

The top is attached to the chest with #8 x 1¼" wood screws through the support rails (screws in the rear rail should be in oversized holes) and two wooden clips per end that are evenly spaced between the rails. I cut the ¼" slots for the clips with a plate joiner; screws hold the clips in place.

The underhung moulding is made at a router table with the lower portion of a specialty moulding router bit (Rockler # 91881). With a wide board stood on its edge, create two profiles then rip the mouldings at your table saw. The moulding is attached to the chest just as the base is – glue and square-head nails.

Supplies

Ball & Ball
ballandball.com or 610-363-7330

- 8 ▸ A69 backplate with A72 drop on post #A000-000, $26.47 each
- 5 ▸ 1¾ x 1¾ Wm & Mary chased, cast escutcheon #L61-002, $17.12 each

Prices correct at time of publication.

Patterns Make Repeating Easy

With the chest assembled, mill and size the drawer fronts to fit the openings – these are flush-fit drawers so keep the reveals at a minimum (1/16" or less). Depending on your preference, at this time either build the drawers or work on the inlay for the drawer fronts.

The drawers are built using 18th-century construction techniques – half-blind dovetails at the front and through-dovetails at the rear. The drawer backs are sized so the drawer bottoms slide under the backs. The bottoms are beveled to fit into 1/4" grooves in the drawer sides and front – the tops of those grooves are cut 3/4" above the edge. Cut a slot in the drawer bottoms even with the inside edge of the drawer back. Nails driven through the slot and into the drawer back secure the bottoms and allow for seasonal movement.

Patterns for the string grooves can be created from a design you already have in mind – or use the plans included here on page 39. To make your own patterns, create a design in a full-size drawing (Google SketchUp is great for this step). Next, select a guide bushing size (for this piece, I used a 3/8"-outside-diameter bushing) and offset the lines to compensate for the bushing. Transfer your new lines to 1/4" plywood then cut out the patterns. Plywood thicker than 1/4" causes problems with the bit length when cutting the grooves.

For this project, three patterns were developed. The included patterns are sized for the top drawers. Because the drawers are graduated, make a second set of patterns (20 percent larger) for the lower three drawers.

Each of the inlay designs is created around a center point. That point is established using one of the top drawers. Find the exact center of the drawer front then measure from the edge of the drawer front to that center point. Each drawer inlay design, whether on the right or left of the drawer, is set to that measurement – all the designs line up vertically on the chest. For the top drawer, draw vertical lines that are equally spaced 2 5/16" off the center point (the line spacing for the larger drawers is 2 11/16"). Also draw a line horizontally as shown in the photo below.

Begin with the twin-bump-shaped pattern. Set the pattern square to the drawer front with the valley of the bumps set at

Proper layout. *The design of the drawer fronts is dependent on getting your layout right. Space the lines off each drawer's center to keep the designs aligned.*

Keep it straight. *The jigs used in this project are all held square to the drawer front. Proper placement is essential to the task.*

That's step one. *These are the first set of lines in the design. The depth should be a strong 1/16" for a secure fit that's easily trimmed after installation.*

Accurate placement. *After the jig is properly placed, the two flat steps at the top of the tulip are where the router guide bushing begins and ends. The bushing snaps into the corner.*

the intersection of the horizontal centerline and one of the 2 5/16" lines. Point the bumps toward the drawer center.

With the guide bushing and a 1/16" straight bit chucked in the router, and the bit set to cut a strong 1/16" into the fronts, locate the bushing at the top end of the pattern, plunge the bit into the drawer front then rout the design. Stop when the bushing hits against the pattern's flat step, completing the pattern. Repeat the steps with the pattern set to the opposite lines, again facing the center.

The second pattern is the tulip design. Place this pattern squared to the drawer front with its top-to-bottom center aligned with the drawer front's centerline. The pattern is also aligned with the outer edge of the twin-bump routed line as shown in the bottom right photo on the opposite page. Begin with the bushing located at one of the corners. Plunge into the wood then rout through the tulip shape until the bushing nestles into the opposing corner.

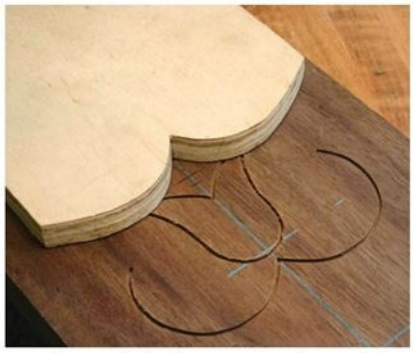
The next two steps of string routing are the most difficult. To locate the wave pattern, you need to lay out a couple lines as shown in the top right photo below. The first line is squared off the drawer front and aligned with the ends of the tulip design. The next line toward the center is half the width of the guide bushing being used. It's used to set the wave pattern square to the drawer front and just at that inside line.

This time, fully plunge the router off the pattern then place the router bit to drop into the tulip line, right at the end. Hold the bit out of the wood and the bushing against your pattern as you start the router then allow the bit to settle into the tulip line. Rout to the center of the pattern then back out toward the second end of the tulip design. When you get to that second line, stop your movement and release the plunge on your router. As you repeat this process for each inlay design, you'll develop a feel and ear for it – you'll hear a different sound as you break into the second line. But on the first couple passes, watch the router bit as you move.

The last bit of pattern work is to reverse the wave pattern and cut in the pointed end. To locate the pattern, measure along the drawer centerline out from the valley of the wave line and place a mark at 1" for the top drawers and 1 1/4" for the other

Step two. *The completed tulip design faces away from the drawer center and is spaced just outside the bump design.*

Plunge to begin. *The tulip top string groove is the first of two grooves that require that you see the bit as you work – or develop a feel for when to stop at the line.*



A simple reversal. *Flip the wave pattern then set the distance between the pattern and the previous groove at 1" for the two top drawers and 1 1/4" for the lower drawers.*

It's all in the base plate. *The arcs around the center of the design are cut using the router base plate as a circle-cutting jig. Place a dowel into the drawer front's centered hole, slip the router plate over the pin then cut the groove from bump to bump.*

drawers. Again, the valley of the wave sits at the intersection. Routing the line is a repeat performance, but on a smaller scale.

The center grooves are cut with a circle-cutting setup. Drill an 1/8" hole at the center of the inlay design. Due to the diameter of the circle being so tight, I simply drilled a 1/8" hole in the router's base plate, set to cut from pattern to pattern. For the top drawers, the radius is 1 11/16" and on the other drawers the radius is 1 15/16". Rest the bit in one of the routed grooves, start the router and rotate it to cut the arced groove. Stop the cut as you reach the opposite string groove. Repeat the steps for the second arc.

Finally, String & Berries

There are straight grooves for inlay, too. The small section between the bumps and the tulip can be routed or you can use a regular screwdriver to punch the surface just deep enough for stringing. The other straight grooves are around the entire perimeter of each drawer. This line is routed using a fence attached to your router. Space the grooves 7/8" from the outside edge of the drawers.

Traditionally, string used in Chester County furniture was made of holly for its white appearance, but I have oodles of scrap maple lying around my shop. That's what I chose for my string. (You can also purchase string material.)

String inlay needs to be sized to fit your grooves. Mill a piece of scrap that's about 3" wide into pieces that are a strong 1/16" thick then rip thin strips from the wider stock – a cutting gauge is ideal for this work.

After the string is made, it's necessary to size each piece. The best method for sizing the string to an exact fit is at your spindle sander. Fit the string between the fence and the drum while pushing into the rotation of the drum. Test the fit. If it's good, you're good. If not, adjust the fence and try it again.

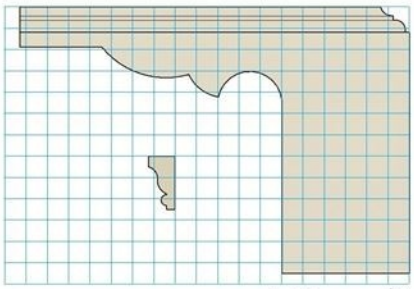
Straight pieces are ready to fit. Miter the corners and, unless your stock is plenty long, use scarf joints to hide additions. The curved pieces are another story. I've tried a variety of methods to bend stringing, but the best I've found is to heat-bend the pieces on a pipe that's heated with a torch. For the larger-diameter curves created with the bump pattern, a 2"-diameter

Sized right. *Clamp a fence at your spindle sander to perfectly size the stringing thickness. Run a sample. If the fit is too tight, adjust the fence and try the setup again.*

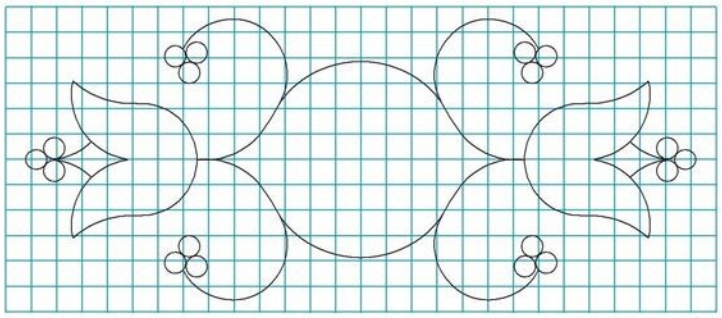
Line & Berry Chest of Drawers

	NO.	ITEM	DIMENSIONS (INCHES) T	W	L	MATERIAL	COMMENTS
❑	1	Case bottom	3/4	20 13/16	39 1/2	Poplar/Walnut	
❑	2	Case sides	3/4	20 1/2	35 3/4	Walnut	
❑	3	Drawer blades	3/4	2	39	Walnut	
❑	1	Rear blade	3/4	2	39	Poplar	
❑	2	Support rails	3/4	1 3/4	39	Poplar	
❑	1	Front top rail	3/4	1 3/4	39 1/2	Walnut	
❑	1	Center divider	3/4	2	9 1/8	Walnut	3/4" TBE*
❑	1	Center runner	3/4	2 3/4	16 7/8	Poplar	1/4" TOE**, 1" TOE
❑	1	Drawer guide	5/8	3/4	15	Poplar	
❑	2	Housed runners	3/4	1	16 7/8	Poplar	1/4" TOE, 1" TOE
❑	4	Runners	3/4	1	18 1/4	Poplar	1/4" TOE
❑	2	Kickers	3/4	1	9 3/8	Poplar	
❑	1	Top	3/4	21 11/16	41 1/16	Walnut	
MOULDINGS & BASE							
❑	2	Side beads	5/16	3/4	33 1/4	Walnut	
❑	3	Blade beads	5/16	3/4	39	Walnut	
❑	1	Divider bead	5/16	3/4	6 7/8	Walnut	
❑	2	Underhung mouldings	5/8	1 1/4	44	Walnut	
❑	1	Base front	3/4	6 1/4	41	Walnut	
❑	2	Base sides	3/4	6 1/4	21 9/16	Walnut	
❑	2	Rear feet	3/4	5 1/2	6 1/8	Poplar	
DRAWERS							
❑	2	Top fronts	3/4	6 5/8	18 5/8	Walnut	
❑	1	#2 front	3/4	7 3/8	38	Walnut	
❑	1	#3 front	3/4	8 1/8	38	Walnut	
❑	1	Bottom front	3/4	8 7/8	38	Walnut	

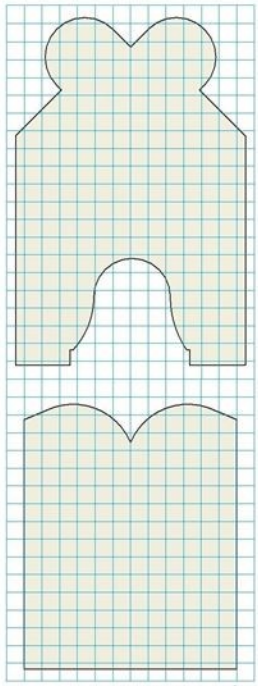
*TBE = tenon both ends, **TOE = tenon one end



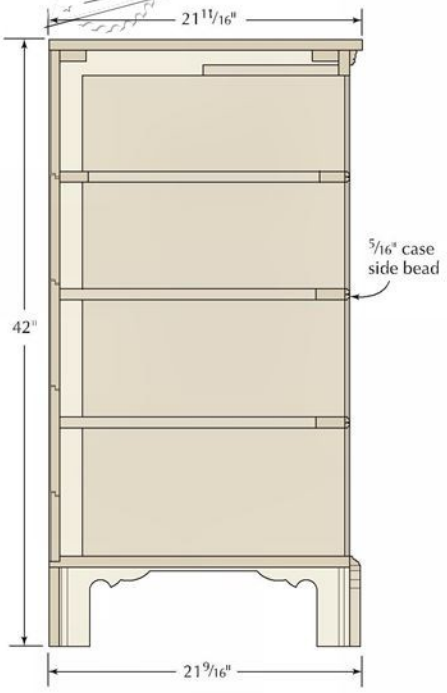
FOOT & TOP MOULDING PATTERNS



INLAY PATTERN



ROUTER PATTERNS



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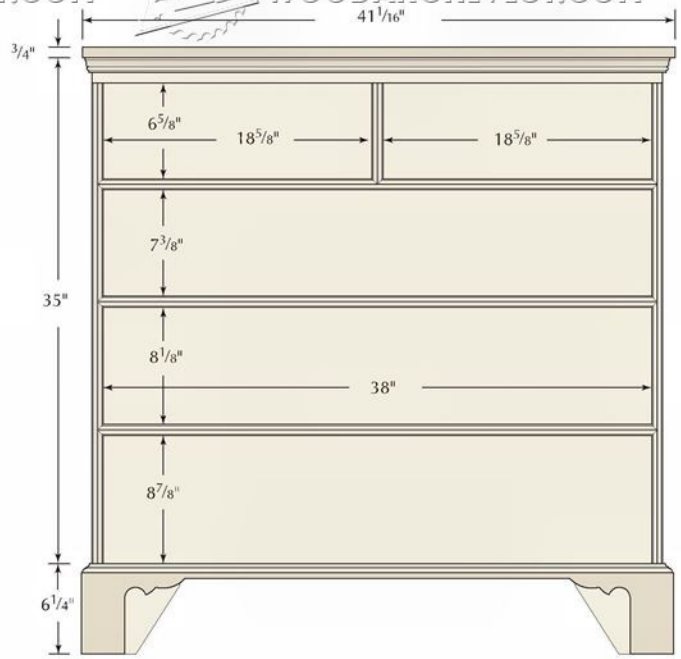


ELEVATION

Hot pipes. *The heat from the torched galvanized pipe steams the water and dries the string at the shape needed to fit into the grooves. It's always good to have pipes of various sizes on hand.*

piece of galvanized pipe works perfectly; 1¼" pipe is ideal for the tulip area.

Heat the pipe until it's hot but not scorching hot – a couple test pieces should clue you to what temperature is best. Lightly wet the string then, using a backer strip such as a piece of pallet banding, bend the string around the heated pipe.

Fit the string to the grooves and don't sweat the areas where the string ends. Those spots get berries to cover the raw ends. The place to work meticulously is where two pieces of string meet. The tighter the fit, the nicer the look. However, as with dovetails, a few imperfections says "handmade."

A few small dabs of glue along the groove keep the string in place. As you tap in the string, the glue chases around the groove. Wipe off any excess when all the string is placed.

The berries are where you become the artist. On the original, each berry cluster – most likely made from red and white cedar – was set with the two berries that touched the vine perfectly aligned with the length of the drawers. A third berry was placed directly at the center while just touching the other two berries. The sym-

Working With Inlay Bits

A 1/16" router bit is used to create the grooves in the line and berry design found on Chester County furniture and elsewhere. Bits available through most suppliers have 1/4" shanks and the cutting length is a short 1/4" at most.

Two potential problems arise when using these bits in string inlay work. First, the cutting length is too short so as not to allow ample depth of cut for your stringing if you push through a guide bushing and beyond a plywood pattern, as we're doing with this project.

Second, the 1/4" shank, when extended enough to reach through the above-described scenario, requires that you use a larger guide bushing than the 3/8" bushing used for the chest – the inside diameter of the bushing is only slightly larger than the shank diameter, so without spot-on setup, the bit has the potential to rub the bushing. What to do?

The first and most simple fix is to use a larger-diameter guide bushing. Working with a larger-diameter bushing reduces the crispness of the design, but allows the bit's shank to easily pass through the guide bushing as the router bit tip reaches your drawer front.

You can also use thin pattern material. With less thickness to pass by, your bit doesn't have to extend as far to cut the grooves. (Remember, it's OK to shorten the length of the guide bushing to make everything work.)

Another option is to use a 1/8"-diameter router bit in conjunction with a collet reducer. This setup (as shown in the photo) allows you to extend the collet reducer beyond the router's collet and if you pull the 1/8" router bit out of the reducer to its fullest extent, the bit's reach is enough to create the grooves without adjustments to either the bushing or your pattern.

One source for the 1/16" straight bit is inlaybandings.com; collet reducers can be found at IMService (cadcam cadcam.com).

Stretching the point. *Collet reducers, chucked into regular collets, can help to lengthen a router bit's reach.*

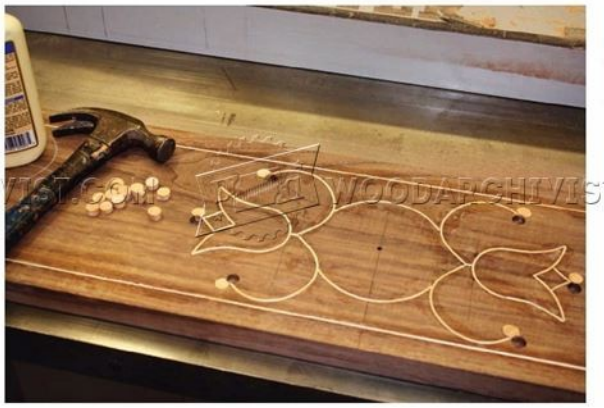
Take your time. *With the stringing bent to closely match the grooves, begin at one end of the run then work to the opposite end. String left in the groove tends to hold its shape better. As you glue the pieces in place, work again from end to end of the groove.*

Berry nice. *The placement of the berries is left to your discretion. I think it's best to have the berries overlap and appear like clusters of grapes on the vine.*

metrical look was very regimented.

My take is to lighten up. I randomly located the berries that touched the vine, and made sure the two lapped, as did the third when it was installed. To do this, you have to install a single berry at a time. Drill an 1/8"-deep x 3/8"-diameter hole at each berry location.

The berries themselves are face-grain plugs, either shop-made or store-bought. Dab glue in the hole then tap in the berry. Use a chisel to flush the berry to the drawer front prior to drilling and installing the second and third berries. I used two cherry berries and a single maple berry for each of my clusters. The choice is yours.



It's a perfect match. *The face-grain plugs that become berries are fit into holes drilled with a 3/8" drill bit. Because of the flat-grain to flat-grain gluing surfaces, the berries will stay put.*

At the Finish Line

With the drawers and drawer front inlay complete, the only woodworking left is the chest back. The backboards run from side to side and fit one another with a tongue-and-groove joint. Each board is nailed with a single nail at each end; the top board has two nails per end.

As for the finish on the chest, stain or dye would reduce the contrast of the string against the walnut background. So, to achieve a deeper color in the walnut while highlighting the string, apply a coat of boiled linseed oil. Follow that with a layer of clear shellac once the oil is dry. From there, I sanded the clear shellac then added multiple layers of amber shellac – the amber color warms the walnut, but also colors the other woods – sanding between coats to smooth the walnut grain. Once I achieved the color I wanted, I returned to clear shellac in order to build a smoothed surface. I thoroughly sanded the shellac before spraying a layer of dull-rubbed-effect pre-catalyzed lacquer to dull and further protect the surface.

After the hardware is added to the drawers (I ordered post-and-nut equipped pulls instead of snipe pins), the chest is ready for use. Mine is going into my bedroom, but you might just want this piece in a high-visibility area. It commands attention. **PWM**

Glen is senior editor of Popular Woodworking Magazine *and teaches woodworking classes and seminars. Contact him at 513-531-2690 x11293 or glen.huey@fwmedia.com.*

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Cross-grain Solutions

BY ALAN TURNER

Methods to prevent cross-grain splits in traditional solid wood case construction.

What is obvious to the seasoned furniture maker often escapes the attention of the newer, aspiring maker. This is especially true when it comes to recognizing and avoiding cross-grain wood movement problems. Wood moves seasonally due to the ability of warm summer air to hold a far greater amount of moisture than cold winter air.

In Philadelphia, we are 60 miles from the ocean and we see the equilibrium moisture content (EMC) of wood at about 6 percent in February and approximately 12 percent in early September. This change from winter to summer causes wood to swell across the grain, and this can easily cause splitting in solid wood parts.

Several trips to the Philadelphia Museum of Art to examine pieces in storage, and in its furniture conservation lab, revealed a number that had experienced some level of failure due to cross-grain construction methods, inelegant cross-grain solutions, or had fallen victim to modern systems of climate control.

Museum conservator Christopher Storb argues that the 18th-century furniture we examined was built well for its time, but that the advent of dry, centrally heated buildings, coupled with poorly conceived repairs, are at least as much at fault as original design flaws.

"It is a mistake to think you can solve any major problems just with potatoes."

— Douglas Adams (1952 - 2001)
British humorist author

Stack them up. *Hot hide glue makes quick work of gluing up a sandwich of corner blocking segments. This tactic prevents the bracket foot from splitting over time.*

Solid Cases with Drawers

Many early pieces were built using solid wood – a slab-sided dovetailed carcase. Having the sides, top and bottom with the grain running in the same direction, works well with itself. But when you introduce drawers to the mix, issues arise. Drawers typically run on rails and need to be supported for their entire length.

Many 18th-century case pieces use a solid wood dust panel immediately behind the primary wood drawer blade. In American pieces, poplar was often used. To avoid the problem of running a drawer rail from front to back (and thus cross grain to the case side), the makers introduced a failure-prone element, a solid wood dust panel sitting at 90° to the direction of the drawer movement. With the drawer sliding across the grain, quick wearing of the poplar was

View from the back. *Here is a the rear of a drawer web frame with the rear tenon's shoulder cut short and left unglued to accommodate movement of the solid wood case side.*

Old nails. *The return moulding is nailed to the case side. There is no splitting so it appears that the old nails were still in use and had not been replaced with modern ones.*

often the result. A different solution was to use a hard maple drawer web frame mounted in a stopped dado.

When building a carcase, your solid wood choices are a single plank (or glued up panel of solid wood), or frame-and-panel construction. With solid wood, the side panels can expand and contract about 1/4", depending upon species and grain orientation. With this slab-sided construction, drawers run on drawer rails, and the rails are cross-grain to the solid wood sides.

On period pieces, the drawer rails were sometimes simply nailed to the case sides with the thought that the nails would give enough to prevent splitting. That usually worked, although the notion of nailing a structural part into a fine piece of furniture is not an attractive option for me.

Also, as Storb noted, nails of the 18th century were forged and quite soft, whereas modern nails, even the reproductions from Tremont, are much harder and thus less easily bent. Seen when effecting repairs, often an old nail will be bent much like the letter "Z" due to cross-grain wood movement. Modern nails do not bend easily and can cause splitting.

A better method is to let a stopped dado carry the weight of the drawer on the rails, and connect the rails in a frame held together with mortise-and-tenon joinery. The trick is to glue in the front and rear drawer blades, glue the front mortise-and-tenon joints that connect the drawer blade to the front of the drawer rails, but not glue the rear mortise-and-tenon joints or the rail into the stopped dado.

Instead, on the rear of the drawer rails, cut the tenon's shoulder about 3/8" short so that, when assembled, there is a gap at the shoulder. Wax the unglued tenon to ensure it does not stick. Then, when the seasons change, the carcase sides will not split.

Applied Mouldings on a Solid Case

Many pieces of furniture are adorned with mouldings, both simple and complex. When these are applied to the front of a piece, glue is all that is needed. The moulding will cause no problems because the grain is running the same direction. But when you turn the corner and apply moulding to the side of a solid-wood case, the moulding and the case side are cross-grain to each other.

The historic way that furniture makers installed the return mouldings was to glue the front several inches at the miter, then nail it to the case the rest of the way back. This works, but it is not a very elegant solution.

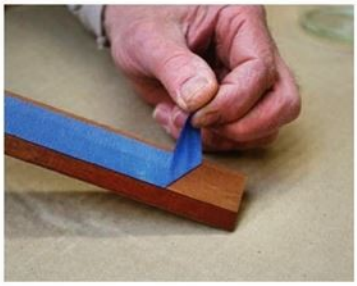
A second way was to cut a dovetail socket on the backside of the moulding, then install a key on the side of the case.

Apply glue to the key in several places and carefully cut the dovetail key into pieces perhaps 2"-3" long, then remove every other one. Slide on the moulding, gluing it only at the front. This can work well, especially for larger mouldings, but on smaller mouldings there may be scant material in the moulding profile to permit the cutting of the socket. And if the piece is inadvertently lifted by the seemingly solid moulding, breakage is likely.

A third method of dealing with the return mouldings on the side of a piece was to make the return moulding of end-grain material, thus avoiding any cross-

End grain return. *In this solid wood dining room piece, the end-grain method for creating the return mouldings was used. This piece was subject to flood damage, so the delicate end-grain mouldings deteriorated.*

Elegant solution. *A plinth built like a drawer web frame with an unglued, short-shouldered tenon at the rear accommodates the side movement.*



Stick here, not there. *Shellac the portion of the moulding that will overhang the solid wood case so you don't accidentally glue the moulding to the solid wood case side.*

grain situation. This is a not-uncommon method seen in New York pieces. While it does avoid the cross-grain conundrum, the end cuts lack strength and are subject to breakage and deterioration, lacking, as they do, any long-grain structure.

Far less common, a fourth way to attach mouldings is similar to the drawer web-frame method. Build a mortise-and-tenon plinth base or top, thinner than the height of the moulding, and attach that to the case in a manner similar to the drawer frame.

Cut the front mortise and tenon in the traditional manner, but make the shoulder about 3/8" short on the rear of the side rails. Glue on the front rail of the plinth, glue the front mortise-and-tenon joints, and glue the rear of the plinth to the case – but do not glue the rear mortise-and-tenon joints and do not glue the side rails to the case.

Glue the moulding to the front of the case, and for the mitered returns, glue them to the side of the front plinth and to the side rail, but not to the end grain of the rear rail. Glue the moulding to the plinth only, and not to the case.

To protect against accidental glue creep onto the case, mark out the thickness of the plinth on the back of the moulding then carefully apply a coat of shellac to the portion of the moulding that will not be glued. Work carefully to prevent glue squeeze-out onto the case.

Glue Blocks & Bracket Feet

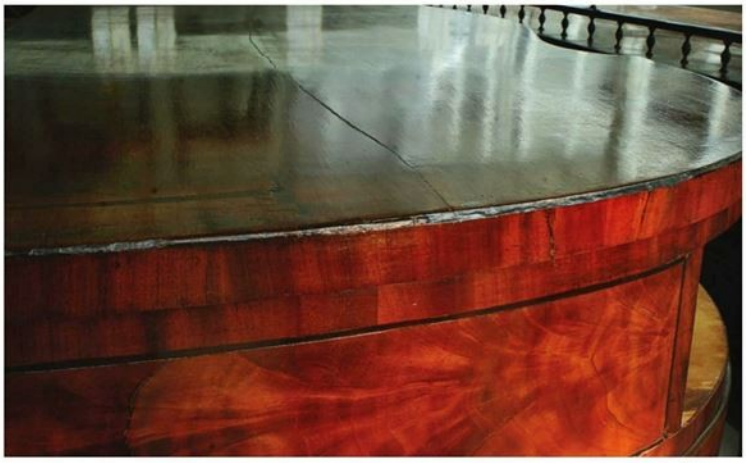
Bracket feet are attractive but generally not structural. Often the weight of a carcase is carried on hidden corner blocks, not on the feet themselves. This is because the bracket feet sit largely beyond the plane of the carcase due to their shape and the typical presence of a base moulding applied to the case.

The usual corner block is a 1" x 1" piece of solid wood about 1/8" longer than the total height of the foot, glued in long grain to the inside corner of each foot. One sometimes sees a split bracket foot because of this cross-grain construction.

To avoid this potential problem, make up a piece of plywood, so to speak. Make a group of 3/4" thick, 1" x 1" squares, and glue them into the inside corner of the feet, one at a time, alternating the grain direction for each layer, as shown in the opening photo.

Classic problem. *Here is a classically split flat-bracket foot below a customary base moulding. Its inner corner is reinforced with a cross-grain glue block.*

The long grain will glue well to the inside of the feet, and the corner block will swell and shrink with the bracket feet as the seasons change. No strength will be sacrificed. Use rubbed, hot hide glue for this procedure and you will not need to mess with a million small clamps. As the glue dries it will tighten up the corner-block stack and you will have a strong and worry-free set of structural feet.



Immovable object*. This solid mahogany sideboard top is badly split. The top itself is only about 1/4" thick, but it is set on an inflexible substrate: a rail-and-stile structure. The top moved but the substrate did not, so it split.*

Flexible connection. *This mock-up shows how a metal fastener can be installed with an oversized hole to avoid cross-grain splits.*

Attach the Top

If you build a slab-sided carcase and add a solid wood top, there are no cross-grain issues. You can simply glue or screw the top to the sub-top of the case. But for attaching a solid wood top to a plywood or frame-and-panel case, the top will move winter to summer, but the case sides will not.

The usual method is to drill for tight-fitting screws in the front to set the overhang, then to cut slots for the rear screws, with the notion that as the top moves seasonally, the slotted holes in the rear will accommodate the movement without splitting the top. This works well, but cutting the slots is fussy work.

An easier method is to drill the rear holes to a proper but generous size for the shank of the screw, then to counterbore from the backside (the top of the sub-top) to provide relief to permit wood movement. Note that at a 20" width, plain-sawn mahogany moves only 3/16" with a 6 percent EMC change, and with cherry and walnut, movement is about 5/16", so not a lot of room is needed for this simple method to be successful.

Chronic back problem. *Common in the period, a rather thin, solid wood back was simply nailed on. Splitting is also common.*

Solid Wood Backs

Certainly it is "period correct" to simply nail on a solid wood back of wide, thin planks and be done with your work. But splitting is pretty common when this method is used. Instead, use narrower boards and shiplap them, attaching each board only in the middle to force the wood movement equally on both edges. Or, if more formality is needed (or more strength), use frame-and-panel construction; that will add rigidity to your work.

With some thought and careful planning, even with the extreme moisture content issues caused by modern heating and cooling systems, one can design solutions to avoid improper cross-grain constructions. PWM

Shipshape solution. *Shiplapped boards, attached only in the middle of each, will avoid the splitting issues inherent in the use of wide planks.*